

## ABSTRACT

### Range Resolved CO<sub>2</sub> Atmospheric Backscattering Measurements Using Fiber Lasers and RZPN Code Modulation

We report the use of a return-to-zero (RZPN) pseudo noise modulation technique for making range resolved measurements of CO<sub>2</sub> within the planetary boundary layer (PBL) using commercial, off-the-shelf, components. Conventional, range resolved, DIAL measurements require laser pulse widths that are significantly shorter than the desired spatial resolution and necessitate using pulses whose temporal spacing is such that scattered returns from only a single pulse are observed by the receiver at any one time (for the PBL pulse separations must be  $> \sim 20$  microseconds). This imposes significant operational limitations when using currently available fiber lasers because of the resulting low duty cycle ( $< \sim 0.0005$ ) and consequent low average laser output power. The RZPN modulation technique enables a fiber laser to operate at much higher duty cycles (approaching 0.04) thereby more effectively utilizing the amplifier's output. This increases the counts received by approximately two orders of magnitude. Our approach involves employing two distributed feedback lasers (DFB), each modulated by a different RZPN code, whose outputs are then amplified by a CW fiber amplifier. One laser is tuned to a CO<sub>2</sub> absorption line; the other operates offline thereby permitting the simultaneous acquisition of both on and offline signals using independent RZPN codes. This minimizes the impact of atmospheric turbulence on the measurement. The on and offline signals are retrieved by deconvolving the return signal using the appropriate kernels.

An assessment of the technique, discussions of measurement precision and error sources as well as preliminary data will be presented.

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